REMARKS/ARGUMENTS

Favorable reconsideration of this application, in view of the above amendments and the following remarks, is respectfully requested.

Claims 1, 3-8, 10-14, and 16-22 are pending in this application. By this Amendment, Claims 1, 8 and 14 have been amended; and Claims 20-22 have been added. It is respectfully submitted that no new matter has been added.

In the outstanding Office Action, Claims 1, 5, 8, 12, 14, and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Suzuki et al. (U.S. Patent No. 6,573,912 B1, hereinafter Suzuki) in view of Kawasaki et al. (Image-Based Rendering for Mixed Reality, Proceedings 2001 International Conference in Image Processing, Volume 3, 7-10, Oct. 2001, pages 939-942, hereinafter Kawasaki), Sillion et al. (Efficient Imposter Manipulation for Real-Time Visualization of Urban Scenery, EUROGRAPHICS, Volume 16, No. 3, 1997, hereinafter Sillion), Dobashi et al. (A Simple, Efficient Method for Realistic Animation of Clouds, SIGGRAPH 2000, hereinafter Dobashi) and Han et al. (U.S. Patent Application Publication No. 2003/0052878 A1, hereinafter Han); Claims 13 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Suzuki in view of Kawasaki, Sillion, Dobashi and Han as applied to Claims 12, 14, and 18 above and further in view of Neugebauer (Geometrical Cloning of 3D Objects Via Simultaneous Registration of Multiple Range Images, Proceedings of the IEEE, 1997); Claims 3, 10, and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Suzuki in view of Kawasaki, Sillion, Dobashi and Han as applied to Claims 2, 9, and 15 above and further in view of Ogata et al. (U.S. Patent No. 6,313,841 B1, hereinafter Ogata); and Claims 4, 6, 7, 11, and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Suzuki in view of Kawasaki, Sillion, Dobashi and Han as applied to Claims 2, 5, 9, and 15 above and further in view of Gannett (U.S. Patent No. 6,118,452).

The purpose of the present invention is to generate a geometrical shape model from a plurality of first images obtained by photographing an object to be rendered from a plurality of directions and second images that pertain to distance information of the object to be rendered, to generate a plurality of microfacets for each voxel, which approximate the shape of the geometrical shape model, and to generate a third image by rotating the generated microfacets in correspondence with a view direction and executing texture mapping depending on the view direction for respective rotated microfacets. In other words, the present invention includes measuring the shape of the object to be rendered by photographing, approximating the shape of the object to be rendered by generating a plurality of microfacets for each voxel, rotating each microfacet in correspondence with the line of vision (viewpoint), and switching a texture for mapping based on the line of vision (viewpoint).

The invention is related to the concepts of triangle-mesh, polygon, billboard and Q-splat, which are used generally in the present technical field. The concept of the microfacet used in the present invention, however, is different since the function of the microfacet used in the present invention and the functions of the triangle-mesh, polygon, billboard and Q-splat function differ.

The triangle-mesh and polygon used in wire frames etc. are used in the case of approximating the surface shape of an object to be rendered. Generally, the surface of an object to be rendered is approximated by connecting the sides and apexes of a plurality of triangle-meshes and polygons. In models using such triangle-meshes and polygons, a concept of rotating each triangle-mesh or each polygon in a direction vertical to the line of vision and a concept of changing textures for mapping depending on the line of vision, do not exist. This is because such characteristics do not exist in "triangle-mesh" or "polygon". Suzuki, which describes a model using triangle-mesh and polygon generated by a Marching

Cube method, describes neither rotating the triangle-mesh and polygon depending on the line of vision nor changing the mapping texture.

In Dobashi, there are no descriptions of utilizing a geometrical shape model generated from a plurality of first images obtained by photographing an object to be rendered from a plurality of directions and second images that pertain to distance information of the object to be rendered, or approximating the shape of the object to be rendered by a plurality of microfacets. In Dobashi, for example, a billboard is generated in an area of a metaball, and the position of the billboard is rotated depending on a viewpoint position (refer to, for example, "5.2.1 rendering clouds"). However, since Dobashi describes a method for visualizing intangibles such as "clouds", the billboard is not generated to approximate the shape of an object to be rendered.

None of Kawasaki, Han, and Sillion describes utilizing a geometrical shape model generated from a plurality of first images obtained by photographing an object to be rendered from a plurality of directions and second images that pertain to distance information of the object to be rendered, approximating the shape of the object to be rendered by a plurality of microfacets, rotating the plurality of microfacets used for approximating the shape of the object to be rendered depending on the line of vision and executing texture mapping based on the view direction.

Kawasaki describes a method of mapping a texture in correspondence with the view point position onto a mesh model. However, since it is a mesh model, the mesh is not rotated in accordance with the view direction.

Han discloses a method of covering up an object to be rendered observed from a predetermined view direction by a Disk (Q-splat). According to the method using this Q-splat, the Q-splat is not rotated depending on the view direction, and texture mapping is not executed in accordance with the view direction. Accordingly, in the Q-splat model, in the

case of observing the object to be rendered from another view point, the gaps increase. Therefore, normally, it cannot be used in the case of changing the view direction (clearly, Han also does not describe the above-mentioned points).

Sillion describes an imposter model for mapping a texture on a patch. Also, in the imposter model, the patch is not rotated depending on the view direction, and texture mapping is not executed in accordance with the view direction. Accordingly, the imposter model is also not usually used in the case of changing the view direction, and, likewise in the case of the Q-splat model (Clearly, Han also does not describe the above mentioned points.).

The Office Action asserts that the claims would have been obvious by combining Suzuki, Dobashi, Kawasaki, Han, and Sillion. However, none of the references describe combining the triangle-mesh polygon, billboard and Q-splat, which have completely different concepts. Rather, no logical basis is asserted, or exists, for such a combination. The triangle-mesh and polygon approximate the surface shape of the object to be rendered. Normally, in the case of moving the line of vision, the object to be rendered is rotated relatively with respect to the viewpoint so that a different triangle-mesh corresponding to a different surface in accordance with the change of line of vision is observed. In the triangle-mesh and polygon models which normally use the above-mentioned method, it is unclear what would result in the case of rotating the triangle-mesh and polygon so that they become vertical to the line of vision as asserted in the Office Action. There is no explanation how each triangle having a different shape would be rotated. However, even if they can be rotated in some way, depending on the viewed direction, the rotated triangle-mesh and polygon may not be able to cover the surface of the object to be rendered from which direction it is viewed. This would result in an image full of gaps. None of the references provide a teaching, suggestion, motivation or other logical reason for the asserted combination. However, even if a

combination as asserted in the Office Action were made, the claimed invention would not be realized.

There are descriptions of a mesh model and polygon on page 12, lines 7 and 15, in the present specification. This is not intended to describe that the characteristic of the microfacet is the same as the triangle-mesh and polygon described in Suzuki. Rather, it is intended to explain that the shape of the microfacet may simply be a "polygonal shape." It is clear from the details of the present specification that the microfacet of the present invention and the triangle-mesh and polygon described in Suzuki used in image processing are different.

Therefore, the claimed features of independent Claims 1, 8 and 14 are neither described by nor rendered obvious by Suzuki, Kawasaki, Sillion, Dobashi, Han or any conceivable combination thereof.

It is respectfully submitted that Neugebauer, Ogata or Gannett each fail to correct the deficiencies of Suzuki, Kawasaki, Sillion, Dobashi and Han described above.

It is respectfully submitted that Claims 3-7, 10-13, and 16-22 are patentable at least for the reasons argued above with regard to the claims from which they depend.

Accordingly, it is respectfully requested that the rejections of Claims 1, 3-8, 10-14, and 16-19 be reconsidered and withdrawn, and that Claims 1, 3-8, 10-14, and 16-22 be allowed.

Consequently for the reasons discussed in detail above no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. Therefore a Notice of Allowance is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in better form for allowance, the Examiner is encouraged to contact the undersigned representative at the below-listed telephone number.

Respectfully submitted,

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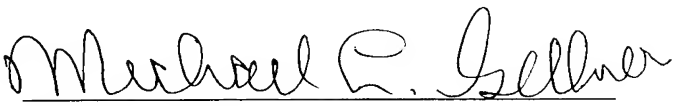

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